

# Conservative adenomyomectomy with transient occlusion of uterine arteries for diffuse uterine adenomyosis

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## Abstract

**Aim:** This study aimed to determine the feasibility and safety of adenomyomectomy with transient occlusion of uterine arteries (TOUA) in patients with symptomatic diffuse uterine adenomyosis.

**Material and Methods:** Twenty-six patients with symptomatic diffuse uterine adenomyosis underwent adenomyomectomy with TOUA by a single surgeon at Ulsan University Hospital between May 2011 and September 2012. Surgical outcomes included operative time, intraoperative injury to blood vessels, nerves, and pelvic organs and operative blood loss. We assessed the degree of improvement in dysmenorrhea and menorrhagia at the 4-month follow-up after completion of adjuvant gonadotrophin-releasing hormone agonist.

**Results:** The mean age of patients was 37.73 years (range, 27–49 years). The mean total surgical time was 95.0 min (range, 60–145 min; SD, 34.49). The mean estimated blood loss was 191.54 mL (range, 80–400 mL; SD, 110.91) and there were no cases of injury to the uterine arteries or pelvic nerves. The mean time of TOUA was 9.79 min (range, 6–16 min; SD, 2.74). The mean duration of hospital stay was 5.65 days (range, 4–7 days; SD, 0.85). There were no major complications requiring reoperation or readministration during the mean follow-up period of 13.5 months. At the 7-month follow-up after adenomyomectomy with TOUA, complete remission of dysmenorrhea and menorrhagia was observed in 94.4% and 100% of patients, respectively.

**Conclusions:** Adenomyomectomy with TOUA could be a safe and effective surgical method in women with symptomatic diffuse uterine adenomyosis to preserve fertility.

**Key words:** adenomyomectomy, diffuse uterine adenomyosis, preservation of uterus, transient occlusion of uterine arteries.

## Introduction

According to the extent or gross pattern of adenomyotic lesions, uterine adenomyosis is classified into two types: focal localized adenomyosis (adenomyoma) and diffuse adenomyosis. There are reports that recommend conservative surgical treatments for focal uterine adenomyoma via laparotomic and laparo-

scopic approaches.<sup>1–5</sup> However, there are only a few reports of conservative surgical treatment in diffuse uterine adenomyosis.<sup>6,7</sup>

Recently, there has been an increasing trend towards conservative surgical therapy in uterine myoma via laparotomy or laparoscopy. Also, women with uterine adenomyosis often want to undergo conservative surgery. The diagnosis of uterine adenomyosis is

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mostly made in women who are in their 30s or 40s and who have usually completed child bearing. For emotional or cultural reasons, these women with uterine adenomyosis do not want their uterus to be removed for a benign uterine disease.

Unlike uterine myoma, conservative surgical treatment of diffuse uterine adenomyosis is much more difficult because of the obscure boundary between adenomyotic lesion and normal myometrium, absence of normal myometrium after completing the excision of adenomyotic lesion, and involvement of the endometrium by the adenomyotic lesion.

Because of these factors, conservative surgery is associated with the risk of bleeding, incomplete surgery, and frequent recurrences. For successful conservative surgical treatment, a lesser bleeding condition is important and necessary. Osada *et al.*<sup>7</sup> introduced a lesser bleeding condition using supracervical tourniquet during laparotomic adenomyomectomy.

We suggest that conservative surgical techniques for diffuse uterine adenomyosis can be safe, completely cytoreductive, and associated with less bleeding. A safe and complete cytoreductive surgery can be performed such that there is lesser bleeding and under stable operative conditions, which can be achieved by transient occlusion of uterine arteries (TOUA) with vascular clips. In the present study, we investigated the feasibility and effect of adenomyomectomy with TOUA in patients with symptomatic diffuse uterine adenomyosis.

## Methods

From May 2011 to September 2012, 26 patients undergoing adenomyomectomy with TOUA were enrolled in this study. The patients were selected consecutively. The inclusion criteria of TOUA adenomyomectomy included the presence of symptomatic diffuse uterine adenomyosis (maximal diameter  $\geq 5.0$  cm or more than a half of uterine body), diagnosis by ultrasonographic examination, adenomyosis refractory to conservative medical treatment, and patient's strong desire for preservation of the uterus. Patients with focally localized adenomyosis or uterine adenomyoma were excluded from this study. Postoperative negative pathological findings of adenomyosis were also excluded. Adenomyomectomy with TOUA using vascular clips was suggested preoperatively to all patients who fulfilled the inclusion criteria, and it was performed with the consent of the patients. The operating time was defined as the period from skin incision to

closure; the size of adenomyosis was defined as the maximal diameter of adenomyosis on ultrasonography; the operative blood loss was estimated by subtracting the rinse volume from the blood volume that was collected in the suction apparatus. Three cycles of adjuvant gonadotrophin-releasing hormone agonist (GnRHa) were injected subcutaneously at a monthly interval after operation. TOUA adenomyomectomy in all cases of the current study was performed by a single surgeon, Y. S. K. This study was approved by the Institutional Review Board of the Ulsan University Hospital.

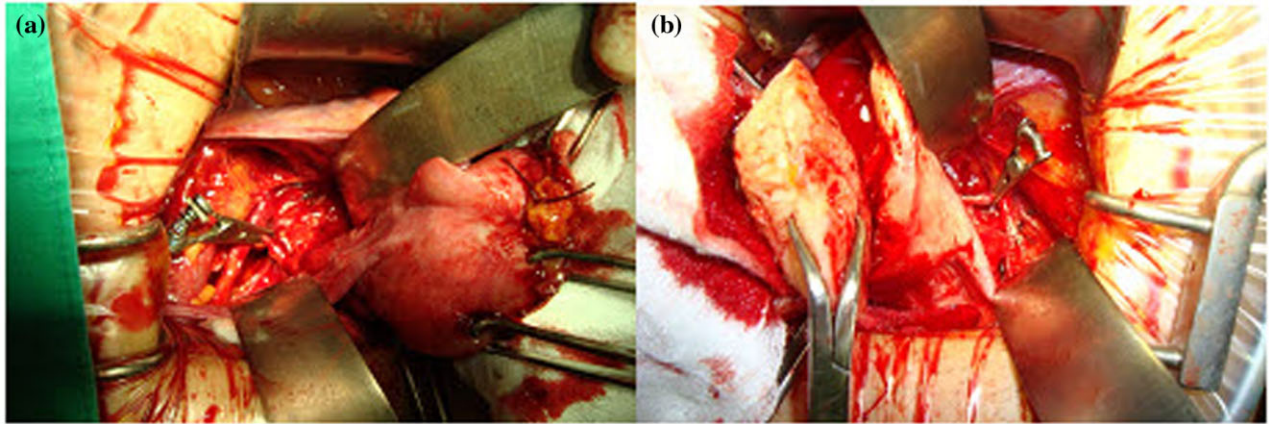
## Surgical technique

The patient was placed in the supine position under general anesthesia with endotracheal intubation. Except for cases with a previous low mid-line incision scar, transverse suprapubic incision was made in most cases to gain access to the peritoneal cavity. The minimum length of transverse incision allowed bilateral isolation and occlusion of uterine arteries. We considered making a transverse incision of approximately 15 cm in length on a practical basis. A large wound retractor (Endo Keeper, Nelis) was applied to obtain a clean boundary of the surgical field and a large surgical field.

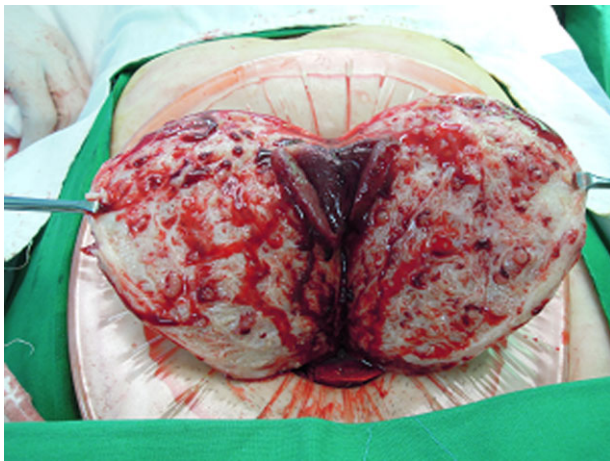
Through the triangular area (round ligament, ovarian ligament and infundibulopelvic [IP] ligament, and psoas muscle) and along the IP ligament, the peritoneum was incised using a monopolar electrode. Using a blunt-tip suction, the umbilical artery was first isolated and the assistant moved the umbilical artery upwards and in the lateral direction. Second, it was possible to isolate the branching uterine artery along the umbilical artery using blunt-tip suction. The isolated uterine artery was occluded by a vascular clip (Temporary Atraumatic Endo-Vessel-Clips; B. Braun Korea). The occlusion of the uterine artery on the other side was performed by employing the same method using a vascular clip (Fig. 1).

Approximately 3 min were spent passing uterine blood out just after completing both transient uterine artery occlusions.

The uterus with diffuse adenomyosis was bisected perpendicular to the axis between the bilateral cornual line from the fundus to the uterine isthmus, the bisection with a scalpel involved the endometrium and it opened the endometrial cavity (Fig. 2). Through visual and tactile sensations, the adenomyotic lesion can be visualized and differentiated from normal myometrial tissues. With preservation of a minimal 5-mm depth of



**Figure 1** Both uterine arteries were occluded by vascular clips during the operation. (a) Right side, (b) left side.



**Figure 2** Bisection with a scalpel involved the endometrium and it opened the endometrial cavity between the bilateral cornual line from the fundus to the uterine isthmus.

the tissues underlying the endometrium, tactile and visual sensations of the operator can help in excising adenomyotic lesion as evenly as possible with a towel clip grasper functioning as traction during the excision (Fig. 3). In the same manner, the serosa covering the lesion was excised with a 5-mm remaining minimal depth of the serosa, which should be preserved for tight uteroplasty after completing excision of adenomyotic lesions. During all excisional procedures, the surgeon should be careful to prevent injury to the fallopian tubes and endometrium.

After completing excision of the adenomyotic lesions, there were excision defects in the uterus, which consisted of the remaining normal uterine portion,

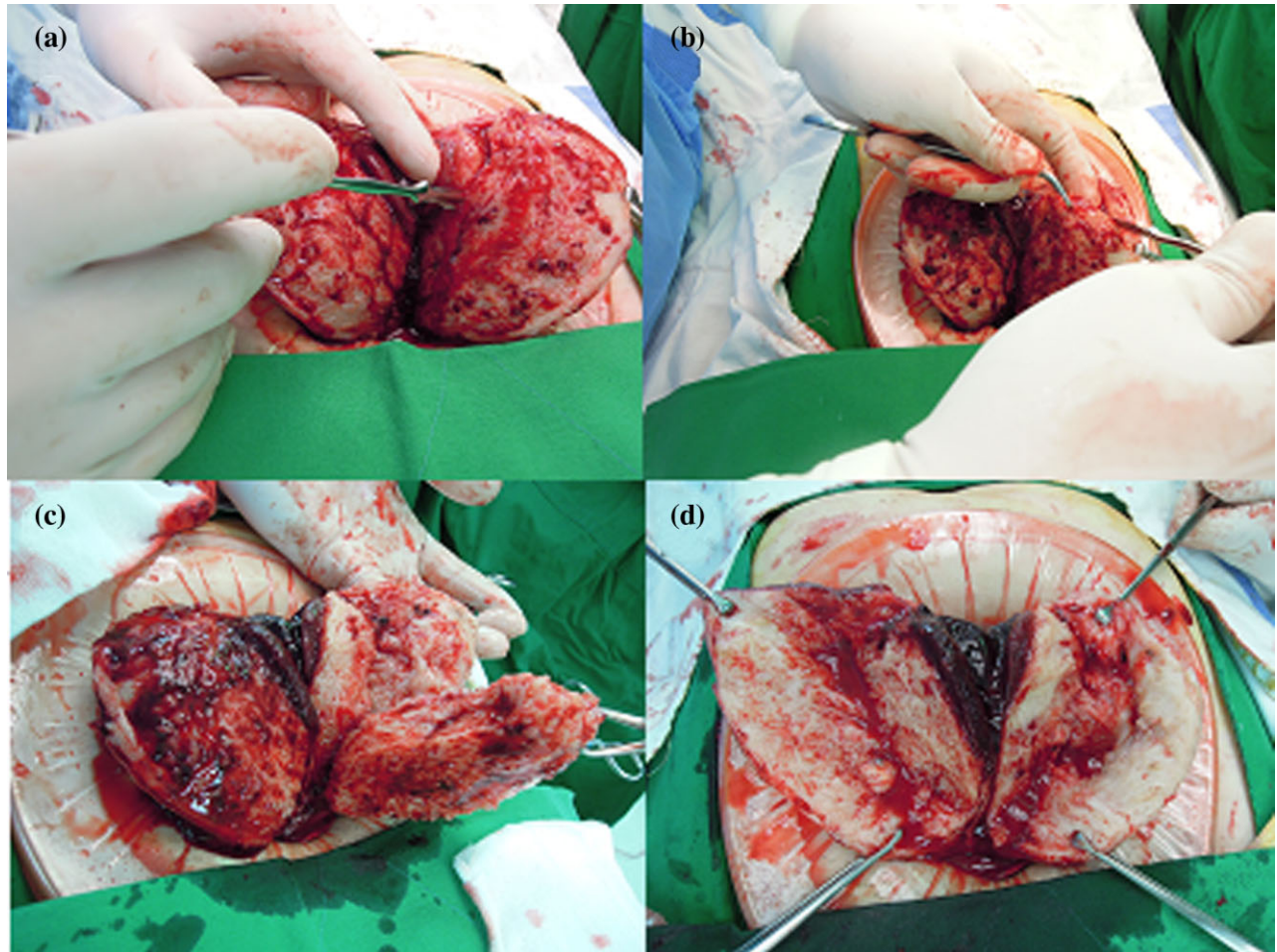
outer serosal surface of about 5 mm in depth, and an inner surface of adenomyotic myometrium and endometrium of 5 mm in depth.

For suturing, the endometrial lining was approximated with interrupted sutures of 3-0 Polysorb (Fig. 4a). Thereafter, the myometrial defects were closed with simple interrupted sutures of 1-0 Polysorb in the out-in-out fashion (Fig. 4b,c); suturing had to be started from the lower and lateral defects and then in the central and upward direction.

Taking care to avoid fallopian tube injury, uterine reconstruction was completed without leaving any dead space. Finally, the initial incision line of the uterine serosa was approximated with continuous running sutures of 3-0 Polysorb (Fig. 4d).

Once uterine reconstruction was completed, the two vascular clips that were placed around the uterine arteries earlier were removed. The reconstructed uterus was irrigated with warm saline for about 1-2 min to identify delayed bleeding or concealed bleeding from the reconstructed uterus. When no active bleeding was found, a closed drain was inserted into the cul-de-sac, and the abdominal incision was then closed in layers.

At the 6-month follow-up, we assessed the improvement in symptoms, including dysmenorrhea and menorrhagia, using questionnaires and we performed ultrasonography to monitor patients for recurrence. The questionnaire with a focus on specific pelvic symptoms included items to evaluate the presence and severity of dysmenorrhea and menorrhagia. The questionnaire was completed by a simple, clinical interview. An 11-point numerical rating scale was used to evaluate intensity of pain during menstruation

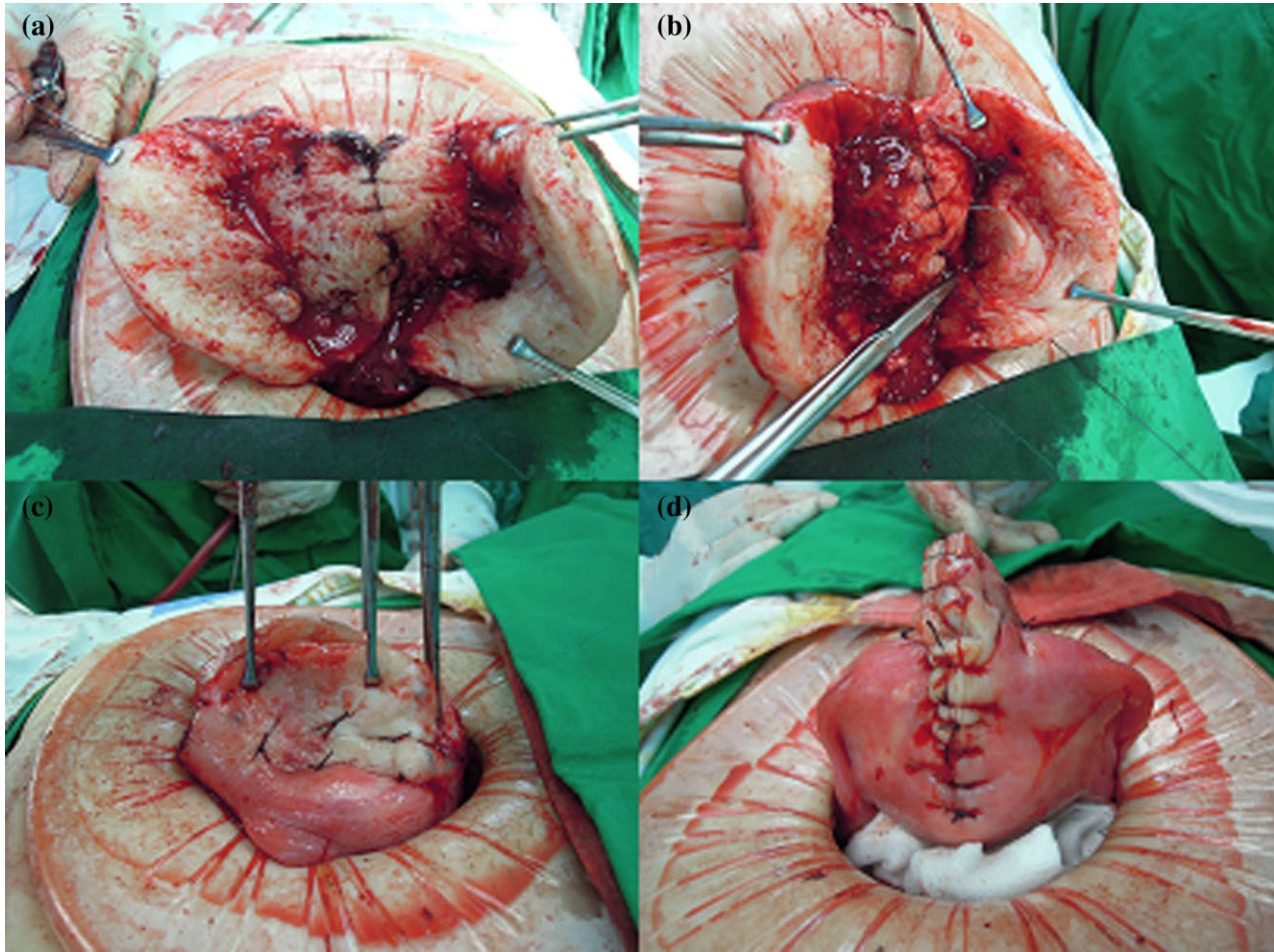


**Figure 3** Excision methods for diffuse adenomyotic lesions. (a) Inserting a fingertip into the endometrial cavity, the excisional procedure of an adenomyotic lesion adjacent to the endometrium. (b) Using a towel clip grasper for traction of the tissues to be excised, the incision of the outer lesion adjacent to the uterine serosa with the minimal depth of more than 5 mm of the myometrium. (c) Total excision of one side of the adenomyotic lesion. (d) No gross excessive uterine bleeding immediately after complete excision of the adenomyotic lesion in both sides.

(0 = no pain, 10 = the pain is as bad as it can be).<sup>8</sup> The Mansfield–Voda–Jorgensen menstrual bleeding scale (MVJ) was used to evaluate menorrhagia. This is a subjective Likert-type scale from 1 (spotting) to 6 (very heavy bleeding or gushing).<sup>9</sup> Complete remission (CR) of dysmenorrhea was defined as 0 on the NRS scale and CR of menorrhagia was defined as 2–3 on the MVJ scale at 6 months after the adenomyomectomy with TOUA. Partial remission (PR) was defined as >50% improvement in symptoms at 6 months after the adenomyomectomy with TOUA. Transvaginal sonography was performed by the same physician, who was not involved in this study and was blinded to preoperative ultrasonographic find-

ings before and after surgery. Criteria for adenomyosis were presence of a myometrial cyst, distorted and heterogeneous myometrial echotexture, poorly defined focus of abnormal myometrial echotexture, and a globular and/or asymmetric uterus.<sup>10</sup> The maximum diameter of the adenomyotic lesion was used for analysis. The criteria for recurrence were increasing size of residual lesions or development of new lesions as detected by ultrasonography during the follow-up period.

SPSS was used for the statistical analysis. Data are expressed as mean  $\pm$  standard deviation (SD) or absolute number (%). The differences were considered significant at a level of  $P < 0.05$ .



**Figure 4** Suturing methods for reconstruction of the defective uterus. (a) Simple interrupted suturing of the bisected endometrium. (b) The myometrial defects were closed with simple interrupted sutures of 1-0 Polysorb in the out-in-out fashion. (c) Lateral view after suturing the defective myometrium in the out-in-out fashion. (d) The view after completing suturing for the reconstruction of the defective uterus.

## Results

From May 2011 to September 2012, 26 patients with symptomatic diffuse uterine adenomyosis, who were refractory to medical treatments and had a strong desire for preservation of the uterus, were enrolled. All the patients underwent a laparotomic adenomyomectomy with TOUA by a single surgeon (Y. S. K.). The mean age was 37.73 years (range, 27–49 years). The major site of adenomyosis was the posterior uterine body (46.2%), and the most common symptom associated with uterine adenomyosis was dysmenorrhea (69.2%) (Table 1).

The mean maximal diameter of uterine adenomyosis was 6.85 cm (range, 5.2–10.4 cm; SD, 1.66). Pathological

**Table 1** Clinical characteristics of the patients ( $n = 26$ )

Age (years)	37.73 $\pm$ 5.53 (27–49)
Main site of adenomyosis	
Anterior body of uterus	9 (34.6%)
Posterior body of uterus	12 (46.2%)
Fundal portion of uterus	5 (19.2%)
Main symptom	
Menorrhagia	9 (34.6%)
Dysmenorrhea	18 (69.2%)
Abnormal bleeding	4 (15.4%)
Combined	7 (26.9%)
Others	2 (%)

Data are mean  $\pm$  standard deviation (range) or absolute number (%). Combined, mixed symptoms of menorrhagia and dysmenorrhea.

evaluation revealed adenomyosis in all patients. The mean total surgical time was 95.0 min (range, 60–145 min; SD, 34.49). The mean estimated blood loss was 191.54 mL (range, 80–400 mL; SD, 110.91), and there were no cases of injury to the uterine arteries or pelvic nerves. The mean time of TOUA was 9.79 min (range, 6–16 min; SD, 2.74). The mean duration of hospital stay was 5.65 days (range, 4–7 days; SD, 0.85) (Table 2). There were no major complications requiring reoperation or readministration during the mean follow-up period of 13.5 months (range, 6–22 months).

At the 6-month follow-up after adenomyomectomy with TOUA, the main symptoms, including dysmenorrhea and menorrhagia, improved (complete remission of dysmenorrhea and menorrhagia occurred in 94.4% and 100% of patients, respectively). Three of the 26 patients revealed remnant adenomyotic lesion or recurrent lesion >1.0 cm in maximum diameter of lesion on ultrasonography (Table 3).

## Discussion

The therapeutic goal for women with symptomatic diffuse uterine adenomyosis that is refractory to medical treatment was relief from adenomyosis-related symptoms or preservation of fertility. Most women with symptomatic uterine adenomyosis have completed child bearing; and recently, there has been an increasing trend towards preservation of the uterus in women with benign uterine tumors.<sup>11–13</sup> The relief of symptoms rather than preservation of fertility is considered more important in the treatment strategy for

women with symptomatic diffuse uterine adenomyosis who are of the age of completing child bearing.

Recently, in patients with focal uterine adenomyoma, a few challengeable conservative surgical treatments via laparoscopy have been reported.<sup>14–18</sup> However, in patients with diffuse adenomyosis, it was difficult to perform complete and safe adenomyomectomy via laparoscopy. Based on our experience of conservative surgical treatment for uterine adenomyoma or adenomyosis via laparoscopy or laparotomy, we suggest that the laparotomic approach is more appropriate than the laparoscopic approach in conservative surgical treatment of diffuse uterine adenomyosis.

The important surgical option among these conservative treatments for symptomatic uterine adenomyoma is maximum surgical excision of adenomyosis with preservation of the uterus. During the diffuse adenomyomectomy, the most important complication is intraoperative heavy bleeding, which frequently can introduce immediate transfusion of blood, incomplete operation, and emergent hysterectomy. To maintain a safe operative condition and clean operation field during diffuse adenomyomectomy, intraoperative bleeding should be controlled. There are a few reports that recommend surgical excision of diffuse uterine adenomyosis in order to avoid complications.<sup>7</sup> In our experience of laparoscopic myomectomy and adenomyomectomy,<sup>18–20</sup> TOUA with vascular clips was applied and it resulted in successful outcomes of controlling bleeding and safe operation. The mean blood loss was 191.54 mL (range, 80–400 mL; SD, 110.91). The mean time of TOUA was 9.79 min, and there were no

**Table 2** Surgical outcomes of adenomyomectomy with transient occlusion of uterine arteries

<i>n</i> = 26	Mean	Range	Standard deviation
Maximal diameter (cm)	6.85	5.2–10.4	1.66
Operation time (min)	95.0	60–145	34.49
Estimated blood loss (mL)	191.54	80–400	110.91
Preoperative Hb (g/dL)	11.56	8.3–13.8	1.43
Postoperative 1 day Hb	9.6	6.8–12.8	1.57
TOUA time (min)	9.79	6–16	2.74
Hospital staying (days)	5.65	4–7	0.85

EBL, estimated blood loss; Hb, hemoglobin; Maximal diameter, maximal diameter of uterine adenomyoma; Time of TOUA, from the time of incision of serosa of right adnexa to the time of occlusion of left uterine artery; TOUA, transient occlusion of uterine arteries.

**Table 3** Clinical follow-up 6 months after adenomyomectomy with transient occlusion of uterine arteries

Main Symptom	CR (%)	PR (%)	Persistent
Dysmenorrhea ( <i>n</i> = 18)	17 (94.4%)	1 (5.6%)	0
Menorrhagia ( <i>n</i> = 9)	9 (100%)	0 (0%)	0
Abnormal bleeding ( <i>n</i> = 4)	4 (100%)	0	0
Gross response	23 (88.5%)	3 (11.5%)	0

Data are expressed as absolute numbers (%). CR, complete remission (NRS scale = 0 in dysmenorrhea at 6 months after treatment, MVJ scale 2–3 for menorrhagia); Gross response, gross response was confirmed by ultrasonography; MVJ, Mansfield–Voda–Jorgensen menstrual bleeding scale (range, 1–6); NRS, numerical rating scale for dysmenorrhea (range, 0–10); PR, partial remission (>60% in symptomatic improvement between before and after treatment); PR in gross response, partial remission in gross response (remnant adenomyotic lesion or recurrent lesion >1.0 cm maximum diameter lesion).

cases of injury to nerves and vessels. Hence this procedure can be considered to be a feasible technique.

In the present study, there were no data on pregnancy outcome after conservative adenomyomectomy with TOUA. This might be due to the following reasons: (i) most women with diffuse uterine adenomyosis had completed child bearing; (ii) the primary goal of treatment was relief of symptoms rather than pregnancy; and (iii) the follow-up period was short (the mean follow-up period was 13.5 months). For assessing the pregnancy outcomes, further long-term follow-up was needed. Severity of the symptoms associated with uterine adenomyosis, dysmenorrhea and menorrhagia was dramatically reduced and the patient satisfaction after adenomyomectomy with TOUA was very high. Laparotomic adenomyomectomy for diffuse uterine adenomyosis has some limitations: (i) unlike the pseudocapsular boundary of uterine myoma, the obscure boundary of an adenomyotic lesion makes it difficult to perform complete excision of adenomyotic lesions, which could result in regrowth or recurrence of adenomyosis; (ii) in spite of careful reconstruction of the uterus, it is difficult to preserve the normal anatomy of both fallopian tubes, and hence an IVF for pregnancy may be necessary due to non-functioning of both tubes; and (iii) the factors affecting the course of pregnancy in the reconstructed uterus are not known. These three limitations have to be resolved in the future for achieving good pregnancy outcomes by performing safe challenging clinical trials. But a remarkable relief in the severity of symptoms was certainly achieved in women with symptomatic diffuse uterine adenomyosis who strongly desired to preserve their uterus. In Asian women, especially Korean women, preservation of the uterus is very important from a psychological and emotional aspect for both the patient and her husband. Among the therapeutic options for diffuse uterine adenomyosis, conservative adenomyomectomy with TOUA using safe and stable procedures is a favorable and satisfactory option in the Korean population.

Another important factor is the suturing technique to minimize dead spaces in myometrial defects after excising adenomyotic lesions. In the present study, the suturing of the defect area after excision of the adenomyotic lesions was performed in three layers, which included approximation of the bisected endometrium, closed suturing of the outer myometrium and inner endometrium, and suturing of the bisected serosal layer. During the postoperative follow-up, acute and late excessive bleeding in the suture sites and

hematoma in the myometrial suture sites were not observed. There were a few reports in which the symptom-relapse rates in the adjuvant GnRH agonist treatment after surgical adenomyomectomy group were significantly lower than those in the surgery-alone group.<sup>13,21</sup> Stopping menstruation by GnRH agonist during the period of uterine healing added to a positive effect by blocking menstrual flow into the operative site of the myometrium, as in all cases of diffuse adenomyomectomy, the endometrial cavity was opened and closed by suturing. Therefore, there was a possibility of endometrial tissues penetrating into the operative site-myometrium. At 4 months after finishing surgical treatment with adjuvant consecutive three-times GnRH agonist, configuration of reconstructive uterus was almost normal as confirmed by ultrasonography. The primary end-point of the present study was the relief of symptoms, which mainly included dysmenorrhea and menorrhagia. The response rate in the present study was 100% for dysmenorrhea and menorrhagia after adenomyomectomy with TOUA. The partial response of both symptoms was not refractory to painkillers – NSAIDs – which were tolerable in the women.

There were a few limitations of this study. It was a single-arm study with a short follow-up period. Randomization is a powerful tool for research or comparative studies. However in the study of operative techniques, it is very important to reduce operator's bias, as it is difficult to adjust skills and technique differences in individual surgeons. The key point in the current study was minimized operator's bias by employing a single surgeon, Y. S. K. Further long-term follow-up will be needed because of secondary outcomes, which included recurrence of symptoms and adenomyotic lesions, long-term complication of TOUA, and pregnancy outcome. Although magnetic resonance imaging (MRI) is better than ultrasonography in evaluating and diagnosing uterine adenomyosis, MRI for diagnosis of uterine adenomyosis is not routinely used because of the Korean medical insurance policy. Transvaginal ultrasonography has a relatively similar accuracy rate to MRI for evaluating uterine adenomyosis.<sup>10,22</sup> It is also useful because of low cost and convenient repeatability. For these reasons, transvaginal sonography was used in this study. The resected tissues were confirmed by pathological assay. In all patients, pathological evaluation revealed adenomyosis. For the preoperative, postoperative and follow-up estimation, the maximal diameter was used as a parameter to estimate the adenomyotic lesion. We

suggest that a combination of diameter of lesion and total weight of resected lesion can be accurately used as a parameter for evaluation of efficacy in surgical treatment of uterine adenomyosis.

In conclusion, to perform a safe and complete laparotomic adenomyomectomy for diffuse uterine adenomyosis, less bleeding can be achieved by TOUA, which is an important additional technique. Adenomyomectomy with TOUA is a surgical option in women with symptomatic diffuse uterine adenomyosis who desire preservation of the uterus.

## Disclosure

The authors declare that they do not have any conflict of interest.

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